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A MARKED CASE OF DOUBLE INVERSION ¹

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I. STATEMENT OF THE CASE AND ITS FAMILY HISTORY

The case here described is that of a small boy reported to the department of psychology by a teacher in one of the villages of Ohio. James entered the first primary and, at the time of writing, was seven years old. His ancestry is questionable, especially on the maternal side as the accompanying chart indicates.² The father, though ignorant and dull, bears a fair reputation for honesty and sobriety. The mother is illiterate, profane, intemperate, and was, prior to her marriage immoral as the family history shows. The

¹ A paper read before the Ohio College Association at Columbus, Ohio, April, 1915.

² The chart and family history were prepared by Mrs. W. J. Koster, of the Bureau of Juvenile Research, Columbus, Ohio.

field worker estimates the mother's mental age at seven or eight years while her boy, according to the Binet scale, tests out five and one-half years. Reference to the chart shows that James' grandparents on the maternal side were feeble-minded; that the grandmother on the maternal side was feeble-minded; that his mother and father are probably feeble-minded; that of two living sibs one is feeble-minded and the other at three years of age does not talk.

JAMES V.

- III 5. James V., born Sept., 1907, in Ohio. Started to school in Sept., 1913; when he began writing, he wrote upside down and backwards. Child is small for his age, slender. Has clear brown eyes. Mother says he is susceptible to colds. Seems fairly bright considering surroundings. James is the oldest of his fraternity. The sibs are:
- III 6. Flossie V., born 1909. Has a marked speech defect. Not averse to "showing off." Copies letters right side up, but is left handed. Has not yet gone to school. Seems of less than normal mentality. (Perhaps of the intelligence of a 4-year child.) Has brown eyes and hair. Small for her age.
- III 7-8. Frank V. and twin, born 1911. Frank's twin died of pneumonia when small. Frank is over three years of age, and makes no attempt to talk. Clear brown eyes. Is plump, but mother says he is sick a great deal.
- III 9. A baby born April, 1914, died Aug., 1914.
Father of III 5:
- II 9. James V., Sr.—A small thin man, lame from tubercular hip; black hair, blue-grey eyes. Is ignorant and opinionated; doubtful if he is of normal mentality. Said to be a hard worker; doesn't drink, is not immoral. "Well-meaning." Chewed tobacco as he talked. Was disposed to be irritated because of the attention given his boy's case. It seems that the boy was kept out of school, as a trachoma suspect at the same time this mirror-writing tendency was discovered; and the father is not able to separate the two facts. Talked to me during my whole stay, insisting that nothing was wrong with the boy's eyes, and that no child could write correctly who had only been in school nine weeks. "They make them write letters before they know their A-B-C's now." I could not make him see why the case had attracted attention,—he was persistently obtuse (really or intentionally), as far as this was concerned. Railed querulously at Dr. Pomeroy and the State Inspector, for having suggested that anything was wrong with the child's eyes.
- Lives in a poor, dingy neighborhood near the river. II 9 is the son of I 4, ——— V. She was a hardworking woman, not of high mental calibre. She was spare, bent and worn when informant knew her. Did washing to support herself and son. She claimed to be a widow, but it was not known that she was ever married.
Mother of III 5:

- II 8. Mrs. Lucy V., age about 42. Lives in same town as James V. Poor neighborhood. House dirty and in some disorder. Since the flood, 1913, the family has been living in two rooms, which were replastered.
- Mrs. V. is an untidy, frowsy woman, of low mentality (7 or 8 yrs.). She is rather stout, with pendulous abdomen. Brown hair and eyes. Chews tobacco as she talks. Seems amiable enough. Formerly immoral; never had venereal trouble. "Too dirty to catch anything," my informant said. During the 1913 flood, she had staying with her, a niece, III 12 ———, with her family. This niece was feeble-minded. Was, if anything, dirtier than Mrs. V (II 8),—was positively filthy. This niece had a son, Chas. ——— (IV), who had papillar conjunctiva, and was taken to Columbus by the Blind Commission to be treated for trachoma. It was on account of close association with this boy, Charles, that James V. (III 5) was kept home as a trachoma suspect.
- II 7. Lucy H. (II 8) was twice married. Her first husband was II 7, Si W. II 7 was an immoral degenerate (doubtless feeble-minded), who finally died of acute alcoholism. This Si W. was the son of I 1 and I 2, cousins, both degenerates, and both finally blind as a result of trachoma. These parents themselves are said to have been the result of inbreeding. Both are now dead. Si W. had three sibs of whom we know something. These are:
- II 1. Alvin W. ("Chickie"). Lived near James V. Was a Salvation Army character. Drank some. (Probably of less than normal mentality.) Was married, but had no children. (Probably sterile.)
- II 3. Jane W. Lived near James V. Now in County Infirmary. She is feeble-minded ("Never had any sense"), and before being taken to the Infirmary, was "common property." There is a suspicion of sterility here, as in spite of her sex activity, she never became pregnant. She has a marked speech defect. Her face is much twisted (asymetrical). She has conical cornea, and is nearly blind.
- II 4. Dave W. Lived near James V. He was not considered bright. Face badly twisted ("could talk into his left ear"). Was a hard drinker and finally died of acute alcoholism. Was married, but had no children. (Probably sterile.)
- Si W. (II 7), before his marriage to Lucy H. (II 8), ran with a woman named ——— S. (II 6), and she had four illegitimate children, presumably by him. These children were:
- III 1. Clyde S. (illegitimate son of ——— S. and Si W.). Was in penitentiary for attempted rape. This was 25 or 30 years ago. The girl who made the charge was an immoral person; many think Clyde should not have been sent. Clyde died unmarried.
- III 2. Walt S. Lives in a small Ohio town.
- III 3. Stella S. Lives in same town as Walt S.
- III 4. Jennison S. Lives in same town as Stella S.; is a Salvation Army Captain. A pretty decent man. Speaks on street corners.

Si W., II 7, later married II 8, Lucy H., but they could have no children. After Si's death, II 8 married II 9, James V., and they have five children, III 5, 6, 7, 8, 9, already described.

Lucy H., II 8, is the daughter of I 5 and I 6, ——— and ——— H. They were heavy set, phlegmatic, German people of less than normal intelligence. Lived on a farm. Lucy has three sibs of whom we know something. These are:

- II 10. Sam H., a feeble-minded alcoholic, who in his younger days was also a thief. He married II 11, Kate K., an immoral woman, with an immoral daughter, probably illegitimate. Kate is brighter than her husband.
- II 13. Jane H., married II 14, "Bluebeard A.," an old man many years her senior. They lived near James V., but have moved away.
- II 15. ——— H., parent of the woman whose son was sent to Columbus for trachoma treatment.

This chart represents parts of three families,—The W.'s, V.'s and H.'s,—all of which are hardly up to the normal in intelligence. They are, for the most part, fairly industrious and inoffensive, and have given comparatively little actual trouble.

II. THE SUBJECT'S SCHOOL RECORD

During the first month of school James seemed hopeless; the only response made for this entire period, after many solicitations, was a statement of his name. He attempted neither writing nor reading and when threatened grew nervous and convulsive. In response to verbal symbols he seemed to be confronted with situations entirely foreign to his previous experiences. He usually withdrew from other children during the period of play except for an occasional game with smaller children whom he often bullied and abused.

At the end of the fifth or sixth week of school the teacher won his confidence sufficiently to induce him to attempt a copy which she had written on the blackboard. It was then discovered that the child invariably perceived the letters of the copy upside down and backwards. From this time on until Christmas all his writing, whether digits or letters, was inverted with respect to the up-down and left-right space relations, except in the case of the word 'cow' which he had painfully learned to trace. In three more weeks the words 'come' and 'me' were added, but very imperfectly. The constant tendency to inversion in the case of these words persisted as is shown by the frequent reversion to incorrect writing.

Unfortunately the earliest writings of the child were destroyed. The following specimens of his somewhat later writings are typical of the character of the writing of this period:

The words 'cow' and 'come' were copied in this manner—
 μοο, εμοο.

In regard to her earlier efforts, the teacher has the following to say: "For days and weeks I tried to get James to write the word 'cow.' I had him go to the board and trace and retrace the copy with his fingers, then with chalk over and over again. Then he was asked to write the word with chalk or pencil as he had traced it; but invariably it was written in inverted order. One afternoon he succeeded, but the next morning all trace of the former success had disappeared." This oscillation of success and failure with reference to the practice word (cow) continued with decreasing number of failures until the holiday recess when he was fairly certain to write the practice word correctly. At the close of his sixth month of school James had learned to write with a fair degree of certainty the drill words 'cow,' 'come,' 'me' and 'James' with the letters in the usual up-down and left-right space relations.

The inversions peculiar to letters apply equally to eight of the nine digits. These were written as follows: 2, 3, 4, 5, 9, 7, 8, 6.

The above account indicates a slow reconstruction of the left-right and the up-down directions. Unfortunately a complete history of the learning of the drill words is not available for the reason that the case was not immediately reported upon discovery. From the available material it is clearly evident that the reconstruction of the inverted directions does not take place simultaneously. Of the two inversions the left right is the more persistent, is less amenable to corrective experience. The reverse might be expected since the horizontal movements of the eye and arm are more readily made. It would seem, therefore, that the similar movements would be more readily coordinated into a system of space relations than the up-down movements of the eye and the forward and backward movements of the arm. But this is not the case. The earliest evidence of corrective experience is found in the up-down relation. Occasionally the digits 6, 7, and 9 are written as follows: 9, 7, 6. The word 'cow' after weeks of effort is frequently written, 'woc.' In these cases it is obvious that the error for the up-down position has disappeared. But this correction is not permanent; the curious phenomenon of oscillation, mentioned above, recurs in that certain writings of the same words or digits are free from this error while others are not. At the end of the seventh month of school a few of the writings of the drill words and the digits still show both kinds of inversions; more of the

writings show only the up-down inversion; while a very small number of writings are spacially correct.

III. THE SUBJECT'S RESPONSE TO UNFAMILIAR WORDS.

With reference to the practice words, once they were mastered, James responded with the usual promptness and confidence characteristic of a seven-year-old child. With reference to new words as 'me,' 'go,' 'nest,' 'see' and 'not' it was very difficult to secure a response of any kind. When asked to copy the word 'nest,' which the teacher had written on the blackboard, he appeared non-plussed, confused. After much persuasion he wrote the letter 't' but refused to write further. The word 'see' was then written on the board and copied as follows—*ss*. The word 'not' was next written




and copied as follows—'ton.' The teacher wrote other words on the board, such as 'bring' and 'buy,' but no amount of coaxing or solicitation could induce him to undertake a copy.










The words 'see,' 'not' and 'go' contain literal elements not entirely new; such letters as 'e,' 'o' and 'n' were met in the practice words, 'cow,' 'come' and 'in.' Hence we find him making attempts to copy these words. But in the words 'bring' and 'buy' the right-hand letters, 'g' and 'y,' with which the writing reaction in the case of James must begin, are strange and unfamiliar. Moreover, the letters 'g' and 'y' are intrinsically difficult.

IV. TESTS IN VISUAL PERCEPTION AND TACTUAL ARRANGEMENT

The purpose of these tests was to determine to what extent tactual and visual perception of directions cooperated in the reconstruction of the subject's up-down and left-right relations of individual letters, of letters in words, of individual digits and digits grouped in two and three place numbers. Geometrical figures were also employed. To this end the teacher cut out the letters of the alphabet and the nine digits from stiff cardboard paper. The various geometrical figures were cut out of sand paper.

The cardboard letters, 'c,' 'o,' 'a,' 'w' and 't' were now placed successively in the subject's hands carefully screened from view. Each letter was twice carefully identified to make sure that it was accurately apprehended. The word 'cow' was then written on the blackboard and James was asked to spell and pronounce it. Immediately after this he was asked to arrange with his fingers the letters, 'w,' 'o' and 'c,' which had been placed promiscuously in his hands, according to the order in which he perceived them on the

blackboard. The letters were carefully screened from view while he arranged them on a table before him. A like procedure applied to the words, 'come' and 'cat;' to the digits, 7, 6, and 4; to the geometrical figures, , , ; to the letters, 'm,' 'w,' 'y,' 'a;' and to the two and three place numbers, 45, 69, 37, and 456, 679, and 283. The results are as follows:

<i>Visual Copy</i>	<i>Tactual Arrangement</i>	<i>Visual Copy</i>	<i>Tactual Arrangement</i>
come.....we			
cow.....wo			
cat.....ta			
M.....W			
W.....M			
Y.....λ			
A.....v			
7.....			
6.....			
4.....			
45.....57			
69.....69			
37.....82			
456.....459			
679.....6*6			
283.....28ε			

The experiment was then repeated twice for each of the words, 'come' and 'cow,' with the following results:

<i>Visual Copy</i>	<i>Tactual Arrangement</i>
come.....omə, ow	
cow.....mo, wc	

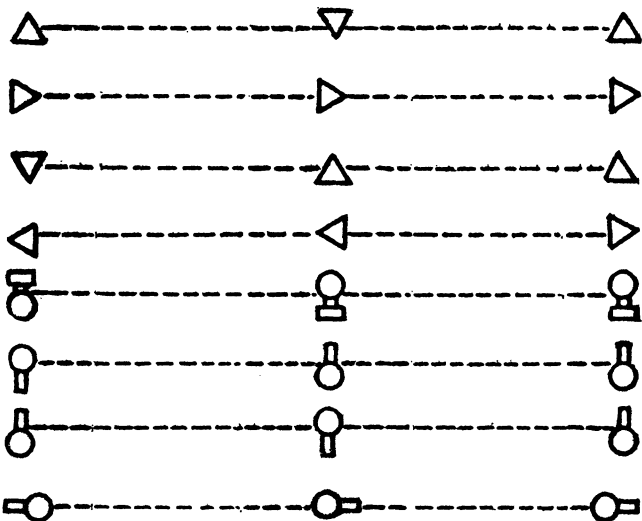
V. TESTS WITH SYMBOLS VIEWED THROUGH THE PSEUDOSCOPE

In these tests the pseudoscope was placed on a box in a position parallel to the line of sight and focused on a definite area of the blackboard. Within this area all letters, words, digits, two and three place figures, and geometrical forms were sure to fall within the visual field of the pseudoscope. The same symbols were employed as in part III with the addition of the word 'rat.' The method of presentation follows that of part III except that in this experiment the sym-

* The 7 in this group of numerals was reproduced in inverted and mirrored form, i.e., the horizontal bar of the 7 was downward and it was turned to the left.

bols were exposed in two series. In the first series they were written or drawn on the focal area in their proper spacial relations. In the second series they were written or drawn in such a way as to invert the normal space relations, *i. e.*, they were presented upside down and backward. The results follow.

<i>Symbols</i>	<i>Seen through pseudoscope when presented in the normal space relation</i>	<i>Seen through pseudoscope when presented in inverse space relation</i>
cow	cow	woc
come	come	əmoɔ
rat	rta	ɹat
cat	ɹɛɔ	tca
7	7	7
6	9	9
4	4	4
M	M	M
Y	Y	Y
A	A	A
45	4ɕ	45
69	*9	†9
456	45*	456
679	679	679
283	28ɕ	28ɕ



* The six appeared in inverted and mirrored form, *i. e.*, the loop was upward and was turned to the right.

† The nine appeared in inverted and mirrored form, *i. e.*, the loop was downward and was turned to the left.

The results of the pseudoscopic tests confirm the observations made under normal conditions. Here as there the phenomenon of oscillation is evident; that a slow process of reconstruction of space relation in response to school demands is going on is also evident.

VI. TESTS WITH FAMILIAR OBJECTS VIEWED THROUGH THE PSEUDOSCOPE

In these tests three common objects were employed—a piece of common chalk shaved down on opposite sides, a pocket knife and a rubber capped pencil. The pseudoscope was again placed on the box and the objects brought into the field of vision. Five readings were taken of each of the following positions:

1. With the knife on top of the chalk.
2. With the chalk on top of the knife.
3. With the knife to the right of the chalk.
4. With the knife to the left of the chalk.
5. With the pencil lying on the table with its rubber tip to the right.
6. With the pencil in the reverse position of "5," *i. e.*, the rubber to the left.
7. With the pencil placed vertically with the rubber at the top.
8. With the pencil placed vertically with the rubber at the bottom.

With respect to the knife and chalk, James was asked at one time to locate the knife with reference to the chalk; at another time he was asked to locate the chalk with reference to the knife. Chance order was followed both with respect to the position of the objects or object and to the interrogations. In case the knife was seen on top of the chalk, he was asked to respond by raising his right hand; in case it was seen to the left, he was to respond with the left hand and so on through the series. Previously it was determined whether James clearly understood what was meant by 'top,' 'bottom,' 'right' and 'left.' The results are shown in the following table:

In six unrecorded cases of left-right confusion the subject failed entirely to respond.

Out of a total of forty responses only seven errors were made. Of these errors six inverted the right and left directions. It is probable that these errors are such as would likely occur even in the normal child of seven years of age. Significant, however, is the fact that all errors, with one exception, should be of the left-right order, since it was observed above that the inversion of the left-right direction is more persistent than the up-down direction. It is also significant that the six cases in which the subject failed entirely to respond should be cases involving the left-right direction. This is suggestive of the first stage in the reconstruction in the space relation of letters in words. With the elimination of the up-down error James' writing parallels that of the common cases of mirror-writing.

VI. THEORETICAL CONSIDERATIONS

The curious mixture of errors, the peculiar alternation of correct with incorrect spacial relations presents an interesting problem in the reconstruction of space perception though a new association of visual and tactual elements. Reference to the experimental data indicates an inversion of the vertical and horizontal visual space relations, but this does not appear to be the case when the same relations are explored tactually. It is possible that touch operates correctively to the original visual experience so that the inverse visual relations take on the normal meaning of top-bottom and left-right relations.

In the seeing person the tactual and visual elements constituting directions form an incomplete fusion so that the relation between the two groups of elements is more or less lax. For this reason a given fusion may, through a change of conditions, be undone and an entirely new fusion may be reconstructed. This may be illustrated by an attempt to trace a figure by means of a mirror in which case the systems of visual and tactual directions must be differently associated than has hitherto been the case in experience. The experiments of Stratton³ illustrate the undoing of the associative bonds which experience has established between visual and tactual direction; they also illustrate the reconstruction of a new association.

In the case here reported it appears that the original associative bonds between the visual and tactual systems of direc-

³ *Psychological Review*, IV, 1897, 341-360 and 463-481.

tion were broken down and a new association established, whose sensory elements were the direct opposite of the original association.

What the teacher is apparently attempting here is to reharmonize disparate space relations through experience. In the normal individual there is probably more or less cooperation between visual and tactual space perception from the very beginning. Through experience this cooperation is made definite and effective so that the space relations gained through these two sense departments become fairly homogeneous. Under normal conditions the two sets of relations may easily be harmonized but in the case under discussion it may be assumed that the visual and tactual space relations were at first inversely related with respect to the normal order and for this reason the two sets of relations reharmonize with difficulty. Instead of correspondence and cooperation we find rivalry and antagonism—the verbal visual left-right and up-down directions contending with the corresponding tactual directions.

Under normal conditions the child just entering school has before him the enormously complex process of correlating the various sensations involved in forming accurate visual and tactual space relations common to words. The finer accessory movements of hand and eye involved in learning verbal symbols for the most part remain uncorrelated until the age of entering school. The underlying mental equivalents of tactual movements involving tactual local signature through experience take on the meaning of the mental equivalents underlying ocular movements involving visual local signature, or vice versa. The series of local signs meaning a given direction in one of these sense departments find a corresponding significance in the local signs of the other. The disparate sets of signs in the case here investigated appear in discord and the development of a fusion of disparate series of corresponding signs is delayed. The earliest responses of James seem to indicate that the meaning of a series of signs in one sense field stood opposed in meaning to the corresponding series in that of the other field. The opposition is clearly in evidence during the period of reconstruction under the direction of the teacher. The persistency of this opposition is evidenced by the “over and over again” tactual tracings of the initial, visually observed, words (‘come’ and ‘me’) and the oscillation of correct and incorrect writings. The reharmonization of the vertical and horizontal directions proceeded with unequal difficulty; the horizontal reconstruction is especially obstinate as is shown by its tardy disappearance.

The efforts of the teacher were thrown on the side of the tactual direction in an effort to bring about correspondence with the visual direction. The enormous number of tracings involved in learning the word 'cow' and the consequent indifferent success does not necessarily establish the primacy of vision for the vertical and horizontal position of digits, letters and the relations of letters in words. Since the tactual directions when tested independent of vision conform more nearly to that of the normal child's writing, progress in the case here described appears dependent upon the subordination of visual direction to tactual, *i. e.*, the visual space directions through the repetition of tactual experiences take on the meaning of the latter.

At first those reactions were eliminated which diverged most from the normal order; successive trials and errors is gradually bringing out of the confusion a fairly consistent and stable space relation of verbal elements and digits.